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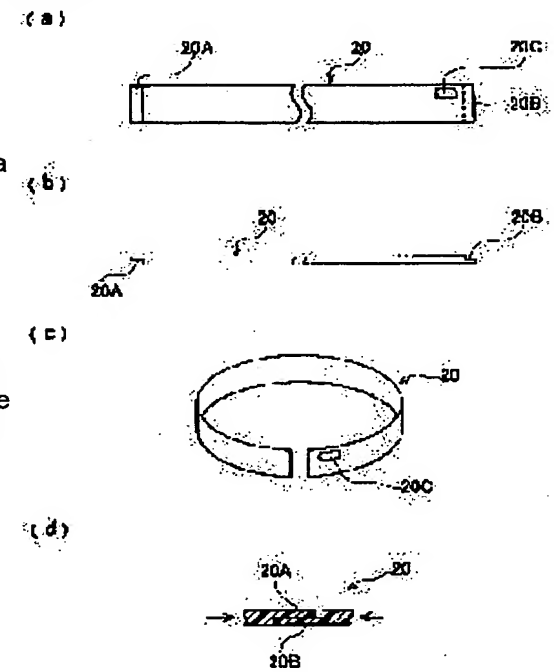
KOIZUMI KATSUYUKI

(54) PLASMA PROCESSING APPARATUS AND ITS ASSEMBLING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To overcome the problem of a prior art such that plasma processing is affected adversely when the surface of a shield member 9 is cut off partially by plasma and the surface treatment film is eliminated and, since a decision is made that the life of the shield member 9 has expired even when a limited part thereof is cut off, the shield member 9 must be replaced and a high cost is imposed for replacing the shield member 9.
SOLUTION: The plasma processing apparatus 10 comprises a lower electrode 12 for supporting a wafer W in a chamber 11, a member 19 for shielding the inner circumferential surface of the chamber 11 from plasma for processing the wafer W supported by the lower electrode 12, and a baffle plate 18 disposed in a gap between the shielding member 19 and the lower electrode 12 in order to discharge gas in the chamber 11 while diffusing, wherein a resin plate 20 is fixed replaceably to the inner circumferential surface of the shielding member 19, and the resin plate 20 is imparted with a compressive stress in the circumferential direction.



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(54) PLASMA PROCESSING APPARATUS AND METHOD FOR ASSSEMBLING THE PLASMA PROCESSING APPARATUS

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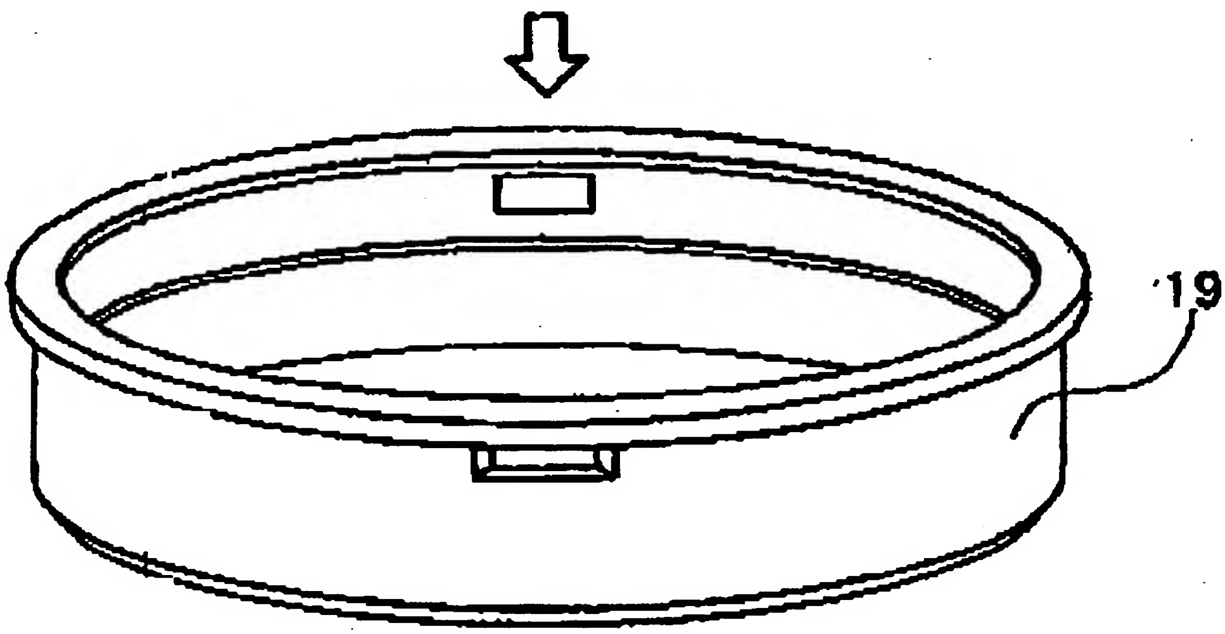
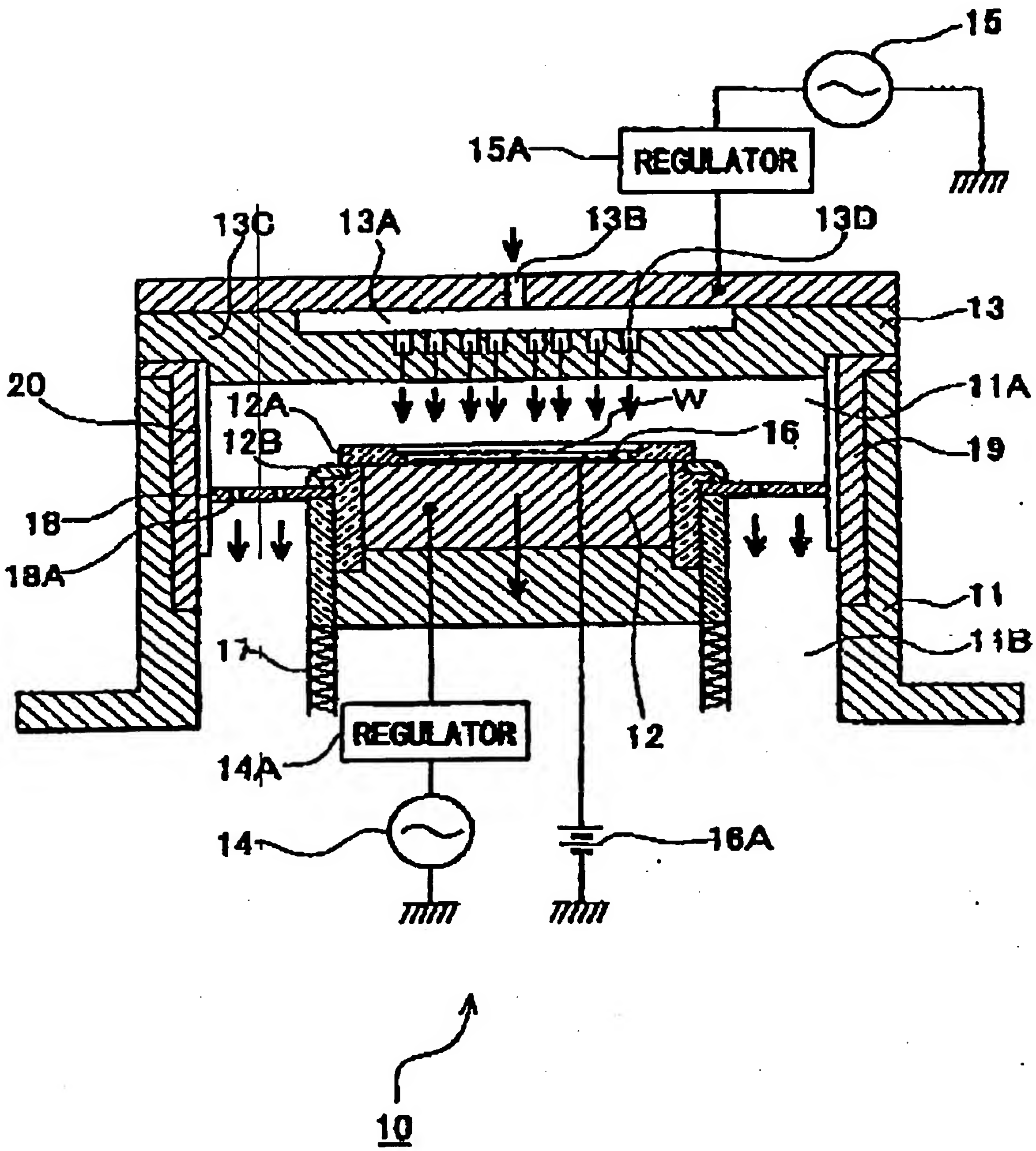
(57) ABSTRACT

The plasma processing apparatus according to the present invention comprises a lower electrode 12 for supporting a wafer W in a chamber 11, shield member 19 for shielding an inside circumferential surface of the chamber 11 from a plasma for processing the wafer W, and a baffle plate 18 disposed in a gap between the shield member 19 and the lower electrode 12, and scattering and exhausting a gas in the chamber 11, a resin plate 20 being removably mounted on an inside circumferential surface of the shield member 19, and a circumferential compression stress being generated in the resin plate 20.




15
15A
REGULATOR
13C
13A
13B
13D
13
20
12A
W
11A
12B
16
19
18
18A
11
17
11B
REGULATOR
12
14A
14
16A
10

F I G. 1

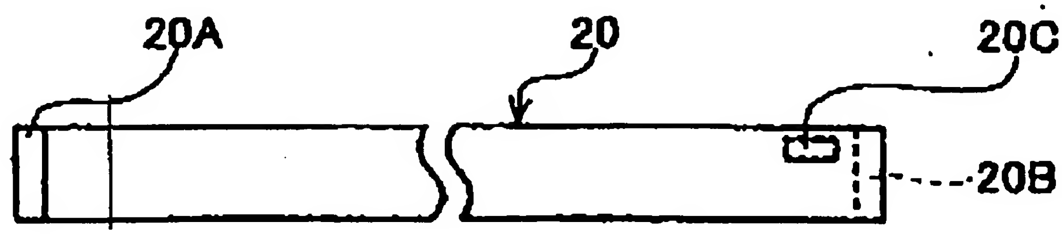


FIG. 2A

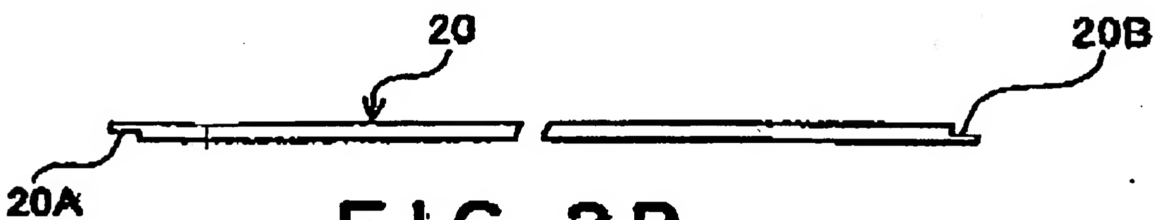


FIG. 2B

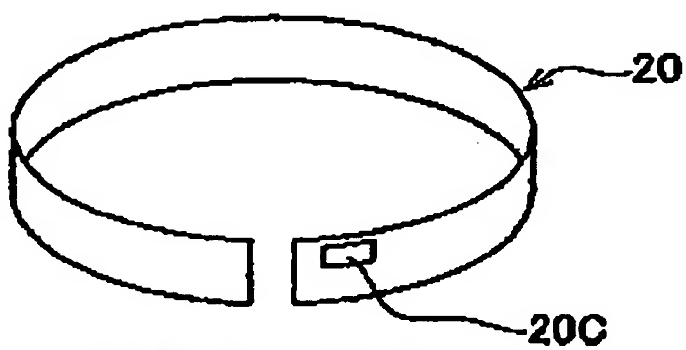


FIG. 2C

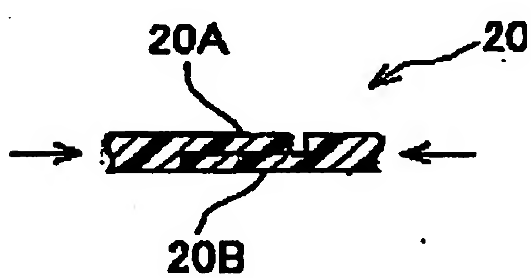


FIG. 2D

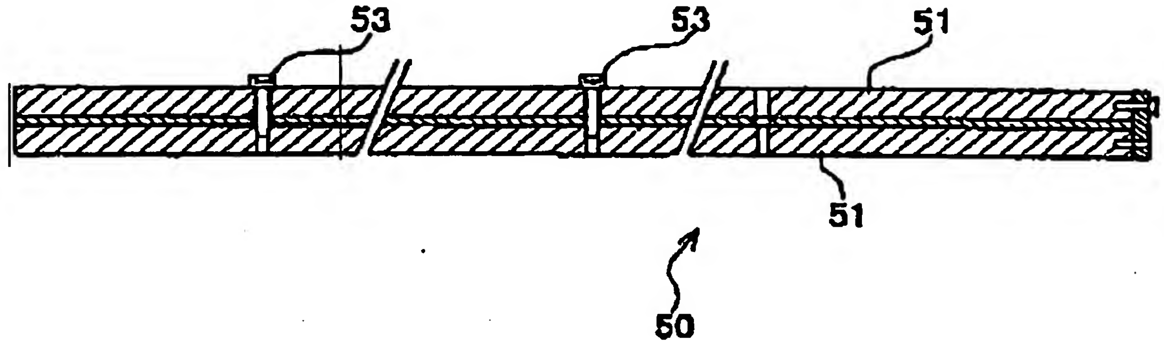


FIG. 3A

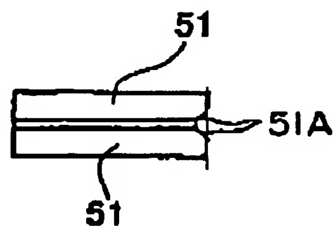


FIG. 3B

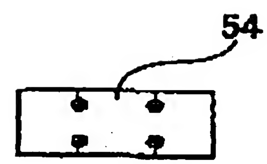


FIG. 3C

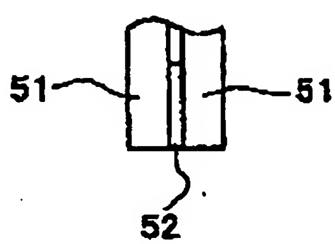


FIG. 3D

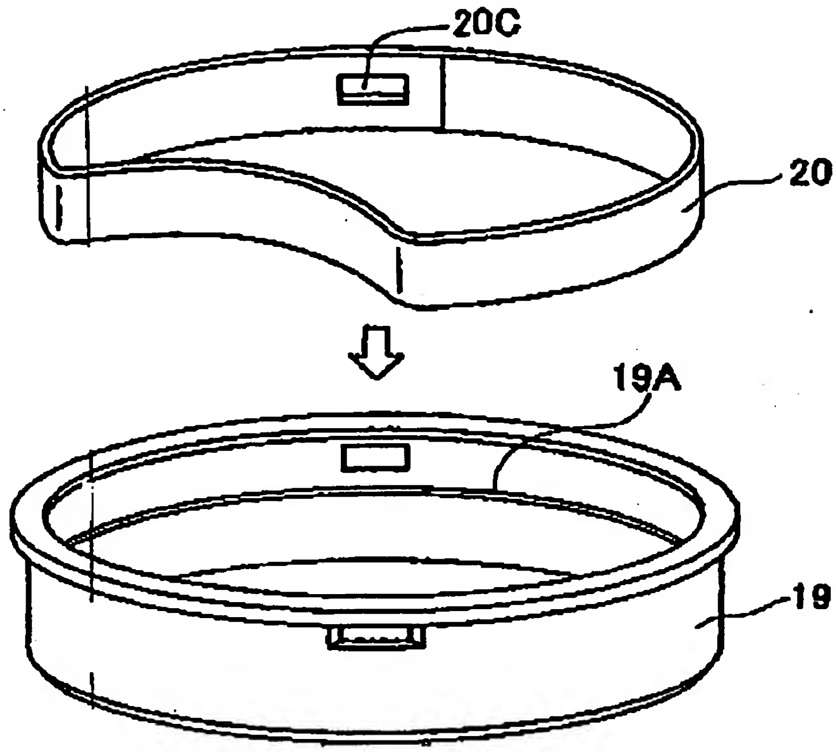


FIG. 4

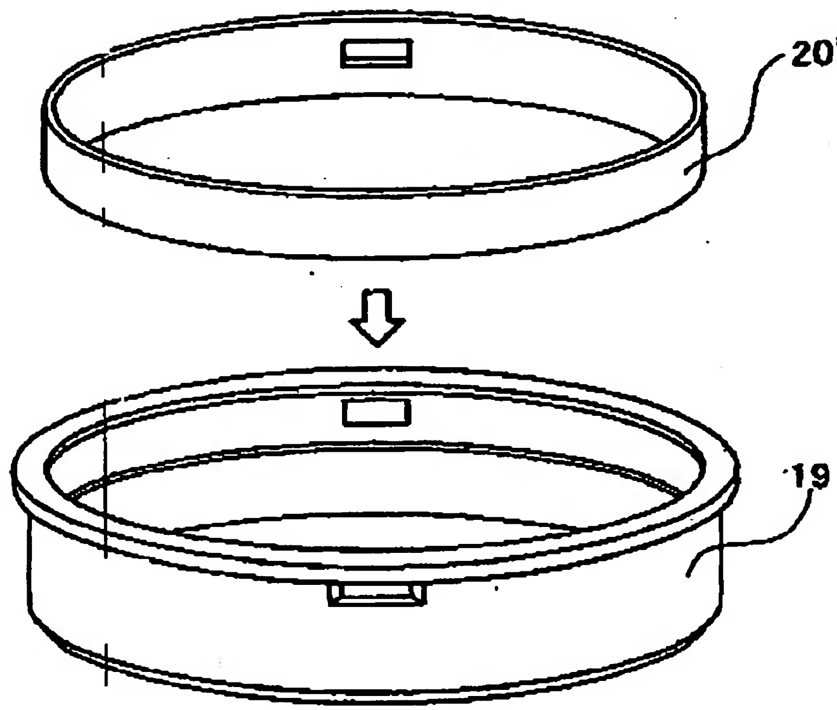
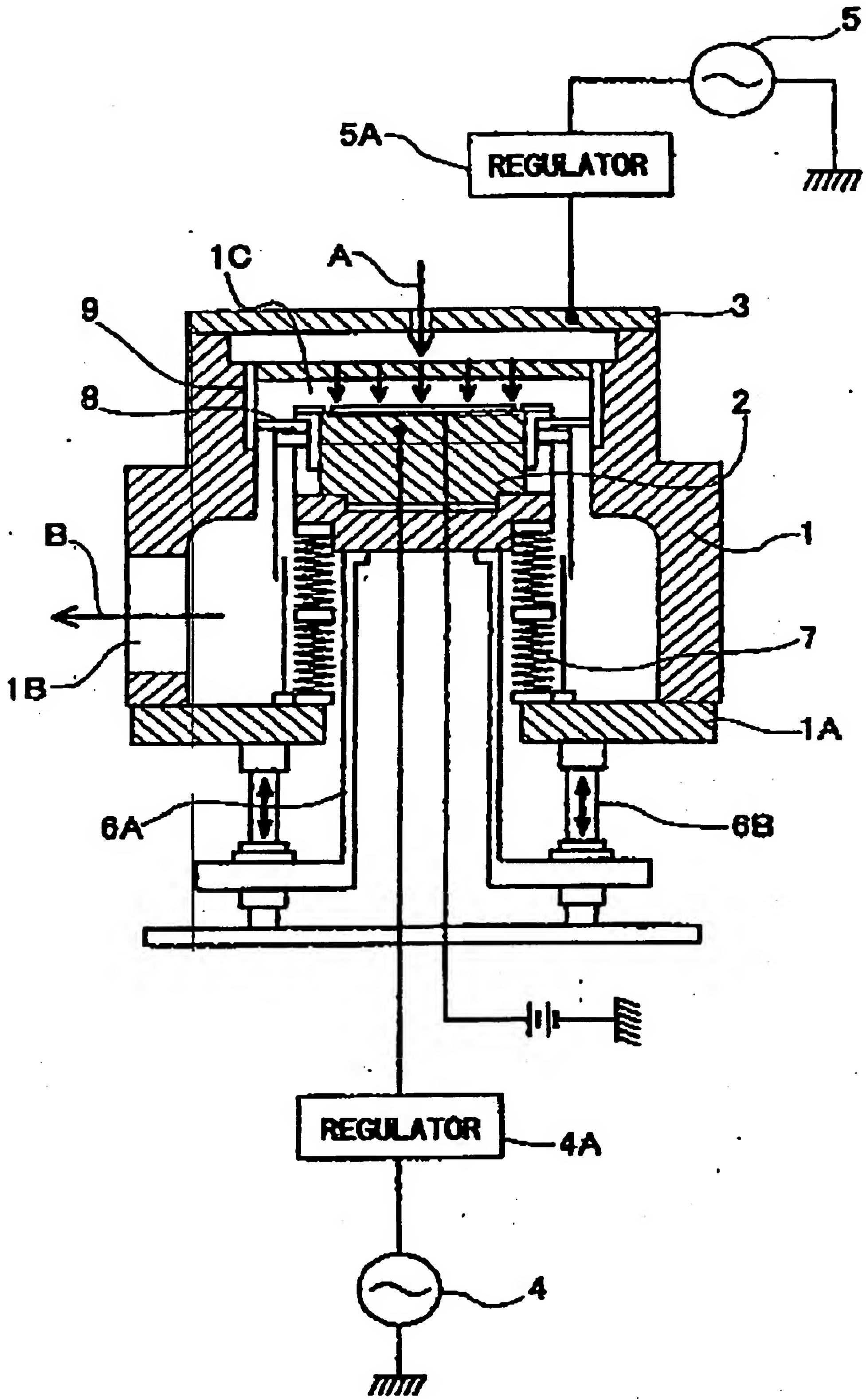


FIG. 5



F I G. 6

PLASMA PROCESSING APPARATUS AND METHOD FOR ASSSEMBLING THE PLASMA PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a plasma processing apparatus and a method for fabricating the plasma processing apparatus, more specifically a plasma processing apparatus having the inside circumferential surface of a chamber improved in maintenance and a method for fabricating the plasma processing apparatus.

[0003] 2. Related Background Art

[0004] A plasma processing apparatus comprises, an exemplified in **FIG. 6**, an air-tight structure processing vessel **1** (hereinafter called "a chamber"), a lower electrode **2** which functions also as a support and disposed on the bottom surface **1A** of the chamber **1**, and an upper electrode **3** disposed above the lower electrode **2** in parallel with the lower electrode **2**. A plasma gas for etching, etc. is fed from the upper electrode **3** into the chamber **1** as indicated by the arrow A in **FIG. 6**. A high-frequency power source **4** for generating plasma is connected to the lower electrode **2** via a regulator **4A**, and a high-frequency power source **5** for generating plasma is connected to the upper electrode **3** via a regulator **5A**. High-frequency powers are applied respectively to the upper and the lower electrodes **2, 3** while a gas for plasma processing is being fed from the upper electrode **3** to thereby generate required plasma between the upper and the lower electrodes **2, 3**, and the used gas is discharged through an exhaust port **1B** as indicated by the arrow B.

[0005] A cylindrical support member **6A** which is passed through a central hole formed in the bottom surface **1A** of the chamber **1** is connected to the lower electrode **2** and interconnected, below the bottom surface **1A**, to a drive mechanism **6B** comprising a ball screw, etc. A bellows **7** is disposed between the outer circumferential surface of the upper end of the support member **6A** and the bottom surface **1A**. Thus, the lower electrode **2** is moved up and down in the chamber **1** by the drive mechanism so as to define a prescribed gap with respect to the upper electrode **3** when plasma processing is carried out.

[0006] A ring-shaped baffle plate **8** is mounted on the lower electrode **2** near the upper end thereof so as to discharge used gas to the exhaust port **1B** from a plasma processing section **1C** in the chamber **1** through the baffle plate **8**. A shielded member **9** is removably mounted on the inside wall surface of the chamber **1**, and protects the inside wall surface of the chamber **1**. The shield member **9** protects the chamber **1** from ion attacks, prohibits the deposition of plasma by-products on the inside wall surface of the chamber **1** to thereby increase the effect of cleaning the chamber **1**. The shield member **9** basically is formed of a material of the same quality as the chamber **1** and has the surface treated with the same surface-treatment as the chamber **1**. For example, when the chamber **1** is made of aluminium having the surface anodized (formed in anodized aluminium film), the shield member **9** as well is formed of aluminium having the surface anodized (formed in anodized aluminium having the surface anodized (formed in anodized aluminium film).

[0007] However, when the shield member **9** has a part of the surface scraped off by plasma and partially loses the surface-treated film, in consideration of a risk that the loss of the surface treated film may affect the plasma processing, the shield member **9** is judged to have worn out as of the time even the loss of the surface is limited to a portion, and the shield member **9** must be replaced, which is a problem. Furthermore, the shield member **9** itself costs much to form, which makes the replacement cost higher, which is also a problem.

SUMMARY OF THE INVENTION

[0008] The present invention was made to solve the above-described problems, and an object of the present invention is to provide a plasma processing apparatus which can prevent the inside wall surface of the chamber or the shield member from being damaged by plasma o that the shield member can be repeatedly used to consequently contribute to reduction of plasma processing costs, and which can prevent the deposition of plasma by-products on the inside wall surface of the processing vessel to thereby increase the cleaning effect, and a method for assembling the plasma processing apparatus.

[0009] The plasma processing apparatus according to the present invention, for generating a plasma in a processing vessel and plasma-processing an object-to-be-processed disposed in the processing vessel, wherein a resin plate is removably mounted on an inside circumferential surface of the processing vessel, which is to contact with the plasma, and a circumferential compression stress is generated in the resin plate.

[0010] The plasma processing apparatus according to the present invention comprises a support for supporting an object-to-be-processed in a processing vessel, a shield member for shielding an inside circumferential surface of the processing vessel from a plasma for processing the object-to-be-processed mounted on the support, and a baffle plate disposed in a gap between the shield member and the support, for scattering and exhausting a gas in the processing vessel, wherein a resin plate is removably mounted on an inside circumferential surface of the shield member, and a circumferential compression stress is generated in the resin plate.

[0011] In the plasma processing apparatus according to the present invention, the resin plate is mounted on the shield member covering at least a portion of the shield member located in a plasma region defined by the baffle plate.

[0012] In the plasma processing apparatus according to the present invention, the resin plate is formed in a strip-shape or a cylindrical shape.

[0013] In the plasma processing apparatus according to the present invention, the strip-shaped resin plate formed into a cylindrical shape, or the cylindrical resin plate has an outer circumferential length longer than an circumferential length of the inside circumferential surface of the processing vessel, or an circumferential length of an inside circumferential surface of the shield member by 0.01-0.4% of the length.

[0014] In the plasma processing apparatus according to the present invention, the strip-shaped resin plate formed into a cylindrical shape, or the cylindrical resin plate has an outer circumferential length longer than an circumferential length of the inside circumferential surface of the processing ves-

sel, or an circumferential length of an inside circumferential surface of the shield member by 0.1-0.2% of the length.

[0015] According to the plasma processing apparatus according to the present invention, the resin plate mounted on the inside circumferential surface of the plasma processing vessel or the shield member prevents the processing vessel of the shield member from being damaged by plasma, and prevent the generation of particles from the processing vessel or the shield member due to ion sputtering, whereby the processing vessel or the shield member can be repeatedly used.

[0016] The method for assembling a plasma processing apparatus according to the present invention, for generating a plasma in a processing vessel and plasma-processing an object-to-be-processed disposed in the processing vessel, comprises the steps of forming a strip-shaped resin plate into a cylindrical shape having an outer circumferential length longer than an inner circumferential length of the processing vessel by overlapping both end portions of the strip-shaped resin plate over each other; contacting the cylindrically formed resin plate to the inside surface of the processing vessel with a part of the cylindrically formed resin plate flexed inward; and causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

[0017] The method for assembling a plasma processing apparatus according to the present invention, for generating a plasma in a processing vessel and plasma-processing an object-to-be-processed disposed in the processing vessel, comprises the steps of contacting a cylindrical resin plate having an outer circumferential length longer than an inner circumferential length of the processing vessel to an inside surface of the processing vessel with a part of the cylindrical resin plate flexed inward; and causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

[0018] The method for assembling a plasma processing apparatus according to the present invention, comprising a support for supporting an object-to-be-processed in a processing vessel, a shield member for shielding an inside circumferential surface of the processing vessel from a plasma for processing the object-to-be-processed mounted on the support, and a resin plate removably mounted on an inside circumferential surface of the shield member, comprises the steps of forming a strip of the resin plate into a cylindrical shape having an outer circumferential length longer than an inner circumferential length of the shield member by overlapping both ends of the strip-shaped resin plate over each other; contacting the cylindrically formed resin plate to an inside surface of the shield member with a part of the cylindrically formed resin plate flexed inward; and causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

[0019] The method for assembling a plasma processing apparatus comprising a support for supporting an object-to-be-processed in a processing vessel, a shield member for shielding an inside circumferential surface of the processing vessel from a plasma for processing the object-to-be-processed mounted on the support, and a resin plate removably mounted on an inside circumferential surface of the shield member, comprises the steps of contacting the cylindrical resin plate having an outer circumferential length longer than an inner circumferential length of the shield member to an inside surface of the shield member with a part of the cylindrical resin plate flexed inward; and causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

[0020] According to the method for assembling the plasma processing apparatus according to the present invention, the resin plate protects the processing vessel or the shield member from being damaged by plasma and prevent the generation of particles from the processing vessel or the shield member due to ion sputtering, and the resin plate can be easily removably mounted on the processing vessel or the shield member, whereby the resin plat can be readily replaced at site.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG 1 is a diagrammatic sectional view of a major part of the plasma processing apparatus according to one embodiment of the present invention.

[0022] **FIG. 2A** is a developed view of a resin plate which is a strip-shaped resin plate used in the plasma processing apparatus shown in **FIG. 1**.

[0023] **FIG. 2B** is a plan view of the resin plate of **FIG. 2A** as viewed from above.

[0024] **FIG. 2C** is a perspective view of the circled resin plate of **FIG. 2A**.

[0025] **FIG. 2D** is a longitudinal sectional view of the resin plate of **FIG. 2A** with both ends overlapped over each other.

[0026] **FIG. 3A** is a longitudinal sectional view of a jig for measuring a length of the resin plate shown in **FIG. 1**.

[0027] **FIG. 3B** is a front view of one end of the jig.

[0028] **FIG. 3C** is a front view of the other end of the jig.

[0029] **FIG. 3D** is an enlarged view of said one end of the jig.

[0030] **FIG. 4** is perspective views of the resin plate shown in FIGS. 2A-2D in the steps of being mounted on the shield member.

[0031] **FIG. 5** is perspective views of a resin plate used in another embodiment of the present invention in the steps of being mounted on a shield member.

[0032] **FIG. 6** is a diagrammatic sectional view of the conventional plasma processing apparatus, which shows a structure thereof.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0033] The present invention will be explained by means of embodiments shown in FIGS. 1 to 5.

[0034] A plasma processing apparatus according to the embodiments shown in FIGS. 1 to 5, comprises, as exemplified in **FIG. 1**, a chamber **11**, a lower electrode **12** for mounting a wafer in the chamber **11**, which is movable up and down, and an upper electrode **13** disposed above the lower electrode **12** in parallel with the lower electrode **12**, and has a fundamental structure based on the conventional

plasma processing apparatus. The lower electrode **12** is connected to a high-frequency power source **14** for generating a bias via a regulator **14A**. The upper electrode **13** is connected to a high-frequency power source **15** via a regulator **15A**. An electrostatic chuck **16** is disposed on the surface of the lower electrode **12**. The electrostatic chuck **16** is supplied with a high voltage by a d.c. source **16A** and electrostatically attracts a wafer W.

[0035] A focus ring **12A** of ceramics, such as silicon carbide or others, is disposed on the outer peripheral edge of the lower electrode **12** to collect a plasma generated between the lower electrode **12** and the upper electrode **13** onto a wafer W by means of it. A protection cover **12B** of, e.g., quartz is disposed on a portion of the lower electrode **12**, which is to contact with plasma. The protection cover **12B** protects the lower electrode **12** from plasma. The upper electrode **13** has, e.g., a cavity **13A**. A processing gas is fed through a gas feed port **13B** formed through the upper portion of the upper electrode **13** at the center thereof and fed into the chamber **11** through feed holes **13D** formed in the lower portion **13C** of the upper electrode **13**. In **FIG. 1**, reference number **17** denotes a bellows.

[0036] An annular baffle plate **18** is disposed on an upper end part of the lower electrode **12**, and a gas which has been used in the plasma processing is discharged, through holes **18A** formed circumferentially in the baffle **18**, from the plasma processing region **11A** to the side of an exhaust region **11B**. The baffle plate **18** is made of, e.g., aluminium having the surface anodized (formed in anodized aluminium film).

[0037] As shown in **FIG. 1**, a cylindrical shield member **19** having a flange on the upper end is mounted on an upper inside circumferential surface of the chamber **11**. The shield member **19** is formed of, e.g., aluminium having the surface anodized (formed in anodized aluminium film) and covers the inside circumferential surface of the chamber **11**. In the present embodiment, a resin plate **20** is further replaceably mounted on the inside circumferential surface of the shield member **19**. The resin plate **20** is made of, e.g., heat-resistant resin. Although a material of the resin plate **20** is not essentially limited as long as the material is heat-resistant, but is preferably made of a polyimide resin, such as VESPEL (trade name of DuPont) or others, a polyimide amide resin, such as SELLASOL (trade name of CLARIANT) or others, or a tetra-ethylene fluoride resin, or others. A material of the shield member **19** is selected to be compatible with a material of, e.g., the chamber.

[0038] The resin plate **20** is formed in a strip as exemplified in FIGS. 2A-2D. The strip has both end portions reduced in thickness, and the both end portions are formed in overlapping portions **20A**, **20B** as shown in **FIGS. 2A and 2B**. When the resin plate **20** is mounted on the shield member **19**, the resin plate **20** is circled as shown in **FIG. 2C**, and the overlapping portions **20A**, **20B** on both ends are overlapped over each other to form the resin plate into a cylindrical shape as shown in **FIG. 2D**. The strip-shaped resin plate **20** formed into the cylindrical shape has an outer circumferential length before mounted which is larger than an inner circumferential length of the shield member **19** by 0.01-0.4%, preferably by 0.1-0.2% of the inner circumferential length of the shield member **19**. An outer circumferential length of the resin plate **20** formed in the cylindrical shape with the overlapping portions **20A**, **20B** overlapped over each other is thus set to be larger than an inner circumferential length of the shield member **19**, whereby when the resin plate **20** is mounted on the shield member **19**, one end surface of one of the overlapping portions **20A**, **20B** is in abutment on the steps of the other overlapping portion, and a circumferential compression stress as indicated by the arrows in **FIG. 2D** is generated in the resin plate **19** to press the resin plate **20** tightly against the shield member **19** to thereby prohibit the resin plate **20** from coming off the shield member **19**. A lateral dimension of the resin plate **20** is so set that the resin plate **20** can cover the inside circumferential surface of the shield member **19** in a region upper of the baffle plate **18** during at least the plasma processing, whereby the shield member **19** is not exposed directly to th plasma. Preferably, a lateral dimension of the resin plate **20** is so set that the resin plate **20** can be extended lower of the baffle plate **18**. A thickness of the resin plate **20** can be suitably set but preferably is set to be about 1.5-2.0 mm in terms of the fabrication. In **FIGS. 2A and 2C**, reference number **20C** indicates a hole as a window for detecting the end of the process.

[0039] It is very important to set a longitudinal dimension of the strip-shaped resin plate **20** with high precision. The resin plate **20** of a too large length or a too small length is difficult to be mounted closely on the shield member **19**. Then, in the present embodiment, the jig **50** shown in FIGS. 3A-3D is used to precisely set a length of the resin plate **20**. The job **50** comprises a pair of plates formed of, e.g., aluminium in strips, a thickness setting member **52** clamped by he pair of plates **51**, **51**, a plurality of screw members **53** which fastening together both plates **51**, **51** with the thickness setting member **52** held therebetween, and a locking plate **54** which blocks one ends of both plates **51**, **51**. Both plates **51**, **51** have the inside surface of the respective upper ends formed in tapered surfaces **51A**, **51A**. The tapered surfaces **51A**, **51A** are guide surfaces for inserting the resin plate **20** into the jig **50**. The jig **50** is placed in a thermostatic chamber (not shown) to be kept in a state in which the jig **50** can be always used at a prescribed temperature (e.g., 23° C.±3°) to precisely set a length of the resin plate **20**. When dimensions of the resin plate **20** are set, the resin plate **20** is inserted between both plates **51**, **51**, and one end of the resin plate **20** is brought into abutment on the locking plate **54**. The other end of the resin plate **20** is a little projected beyond the other end of the jig **50**, and the projected portion of the resin plate **20** is cut off to thereby precisely set the resin plate **20** in a prescribed length. The jig **50** can be also used as a jig for delivery inspection.

[0040] Then, a method for mounting the strip-shaped resin plate **20** on the shield member **19** will be explained by referring to **FIG. 4**. The overlapping portions **20A**, **20B** on both ends of the strip-shaped resin plate **20** are overlapped over each other to form the strip-shaped resin plate **20** into a cylindrical shape. A part of the cylindrical shape in this state is flexed inward as shown in **FIG. 4** to be easily inserted into the shield member **19**. Then, as indicated by the arrow, the cylindrical part of the resin plate **20** is overlapped over the inside circumferential surface of the shield member **19**, and then the inwardly flexed part is flexed back toward the inside circumferential surface of the shield member **19** to restore the cylindrical state, and the resin plate **20** is tightly contacted to the inside circumferential surface of the shield member **19** over the entire circumference. The outer cir-

cumferential length of the resin plate **20** is larger than an inner circumferential length of the shield member **19** by 0.01-0.4%, preferably by 0.1-0.2% of the length of the shield member **19**, whereby a compression stress is generated circumferentially in the cylindrical resin plate **20** to be tightly contacted to the inside circumferential surface of the shield member **19** while a reaction force is generated circumferentially in the cylindrical resin plate **20**. Resultantly, the resin plate **20** expands its inner diameter to be tightly contacted to the inside circumferential surface of the shield member **19**. The resin plate **20** in this state cannot easily come off. A step **19A** formed on the inside circumferential surface of the shield member **19** abuts on the lower end of the resin plate **20**.

[0041] The shield member **19** with the resin plate **20** mounted on is mounted on the inside circumferential surface of the chamber **11**, and the plasma processing apparatus **10** comprising the chamber **11** having the inside circumferential surface of the chamber **11** in the plasma generating section covered with the resent plate **20** as shown in **FIG. 1** is assembled. In making plasma processing on a wafer W by using the plasma processing apparatus **10**, ions in the plasma attack the inside circumferential surface of the chamber **11** due to a potential difference between a plasma potential and a ground potential of the chamber **11**. In the present embodiment, the resin plate **20** covering the shield member **19** mounted on the inside circumferential surface of the chamber **11** is sacrificed to protect the shield member **19** from being damaged. Furthermore, in the present embodiment, in which ions do not directly attack the shield member **19**, as do in the conventional plasma processing apparatus, no particle is caused by the ion sputtering, which can improve yields of the plasma processing. When the resin plate **20** is worn by the plasma processing, the worn resin plate **20** is simply replaced so that the shield member **19** itself can be repeatedly used. Furthermore, the resin plate **20** can be easily removed from the shield member **19** so that the resin plate **20** can be readily replaced at site.

[0042] When by-products are generated in plasma, the by-products are deposited on the inside circumferential surface of the resin plate **20** without being deposited directly on the shield member **19**. Accordingly, when the chamber **11** is cleaned, the resin plate **20** is simply replaced without performing the cleaning. The cleaning can be efficient.

[0043] As described above, according to the present embodiment, the resin plate **20** is replaceably mounted on the inside circumferential surface of the shield member **19**, and besides a circumferential compression stress is generated in the resin plate **20**, whereby plasma is prohibited from entering between the resin plate **20** and the shield member **19** to thereby damage the shield member **19**. When the resin plate **20** is worn, the resin plate **20** is simply replaced by a new one so that the expensive shield member **19** can be repeatedly used as it is, which can contribute to the cost reduction of the plasma processing apparatus. The resin plate **20** can be readily replaced at site. By-products of plasma are deposited on the resin plate **20** without being deposited directly on the shield member **19**, which allows the cleaning of the inside circumferential surface of the chamber **11** to be omitted, and the cleaning can be efficient. The resin plate **20** is light and does not take up space, and supplies of the resin plate **20** can be readily stored.

[0044] **FIG. 5** shows a resin plate **20'** of another embodiment of the present invention in a state of the resin plate **20'** mounted on a shield member **19**. The resin plate **20'** is initially formed in a cylindrical shape. A circumferential length of the resin plate **20'** is the same as a length of a strip-shaped resin plate **20** formed in the cylindrical shape. That is, an outer circumferential length of the cylindrical resin plate **20'** before mounted on the shield member **19** is set to be larger than an inner circumferential length of the shield member **19** by 0.01-0.4%, preferably by 0.1-0.2% of the inner circumferential length of the shield member **19**.

[0045] When the cylindrical resin plate **20'** is mounted on the shield plate **19**, as is shown in **FIG. 4**, the resin plate **20'** is mounted on the shield member **19** while a part of the cylindrical resin plate **10'** is being flexed inward. When the resin plate **20'** is mounted on the shield member **19**, a circumferential compression stress is generated in the resin plate **20'** while a force to expand a diameter of the resin plate **20'** is exerted, whereby the resin plate **20'** is tightly contacted to the shield member **19**. In the present embodiment as well, the same advantageous effects as produced by the above-described embodiment can be produced. In **FIG. 5**, a step **19A** formed on the inside circumferential surface of the shield member **19** is abutted on the lower end of the resin plate **20'**.

[0046] The present invention provides a plasma processing apparatus which can prevent the inside wall surface of the chamber, or the shield member from being damaged by plasma so that the processing vessel or the shield member can be repeatedly used to consequently contribute to reduction of plasma processing costs, and which can prevent the deposition of plasma by-products on the inside wall surface of the processing vessel or on the shield member to thereby improve the cleaning effect, and a method for assembling the plasma processing apparatus.

What is claimed is:

1. A plasma processing apparatus for generating a plasma in a processing vessel and plasma-processing an object-to-be-processed disposed in the processing vessel, wherein

a resin plate is removably mounted on an inside circumferential surface of the processing vessel, which is to contact with the plasma, and

a circumferential compression stress is generated in the resin plate.

2. A plasma processing apparatus comprising a support for supporting an object-to-be-processed in a processing vessel, a shield member for shielding an inside circumferential surface of the processing vessel from a plasma for processing the object-to-be-processed mounted on the support, and a baffle plate disposed in a gap between the shield member and the support, for scattering and exhausting a gas in the processing vessel, wherein

a resin plate is removably mounted on an inside circumferential surface of the shield member, and

a circumferential compression stress is generated in the resin plate.

3. The plasma processing apparatus according to claim 2, wherein

the resin plate is mounted on the shield member covering at least a portion of the shield member located in a plasma region defined by the baffle plate.

4. The plasma processing apparatus according to any one of claims 1 to 3, wherein

the resin plate is formed in a strip-shape or a cylindrical shape.

5. The plasma processing apparatus according to any one of claims 1 to 4, wherein

the strip-shaped resin plate formed into a cylindrical shape, or the cylindrical resin plate has an outer circumferential length longer than a circumferential length of the inside circumferential surface of the processing vessel, or an circumferential length of the inside circumferential surface of the shield member by 0.01-0.4% of the circumferential lengths of the processing vessel or the shield member.

6. The plasma processing apparatus according to any one of claims 1 to 4, wherein

the strip-shaped resin plate formed into a cylindrical shape, or the cylindrical resin plate has an outer circumferential length longer than a circumferential length of the inside circumferential surface of the processing vessel, or an circumferential length of the inside circumferential surface of the shield member by 0.1-0.2% of the circumferential lengths of the processing vessel or the shield member.

7. A method for assembling a plasma processing apparatus for generating a plasma in a processing vessel and plasma-processing an object-to-be-processed disposed in the processing vessel, comprising the steps of:

forming a strip-shaped resin plate into a cylindrical shape having an outer circumferential length longer than an inner circumferential length of the processing vessel by overlapping both end portions of the strip-shaped resin plate over each other;

contacting the cylindrically formed resin plate to the inside surface of the processing vessel with a part of the cylindrically formed resin plate flexed inward; and

causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

8. A method for assembling a plasma processing apparatus for generating a plasma in a processing vessel and plasma-processing an object-to-be-processed disposed in the processing vessel, comprising the steps of:

contacting a cylindrical resin plate having an outer circumferential length longer than an inner circumferential length of the processing vessel to an inside surface of the processing vessel with a part of the cylindrical resin plate flexed inward; and

causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

9. A method for assembling a plasma processing apparatus comprising a support for supporting an object-to-be-processed in a processing vessel, a shield member for shielding an inside circumferential surface of the processing vessel from a plasma for processing the object-to-be-processed mounted on the support, and a resin plate removably mounted on an inside circumferential surface of the shield member, the method comprising the steps of:

forming a strip of the resin plate into a cylindrical shape having an outer circumferential length longer than an inner circumferential length of the shield member by overlapping both ends of the strip-shaped resin plate over each other;

contacting the cylindrically formed resin plate to an inside surface of the shield member with a part of the cylindrically formed resin plate flexed inward; and

causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

10. A method for assembling a plasma processing apparatus comprising a support for supporting an object-to-be-processed in a processing vessel, a shield member for shielding an inside circumferential surface of the processing vessel from a plasma for processing the object-to-be-processed mounted on the support, and a resin plate removably mounted on an inside circumferential surface of the shield member, the method comprising the steps of:

contacting the cylindrical resin plate having an outer circumferential length longer than an inner circumferential length of the shield member to an inside surface of the shield member with a part of the cylindrical resin plate flexed inward; and

causing the flexed resin plate to restore the cylindrical shape and generating a circumferential compression stress in the resin plate.

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